A

Ph.D. SYNOPSIS /WORK PLAN

on

ISOLATION, CHARACTERIZATION, PARTIAL PURIFICATION AND ANTIMICROBIAL ACTIVITY OF DRUG FROM LEAVES OF INSULIN PLANT.

Submitted to

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Format for submission of Ph.D. Synopsis / Work plan

Abstract of proposed work plan/ problem:

ISOLATION, CHARACTERIZATION, PARTIAL PURIFICATION AND ANTIMICROBIAL ACTIVITY OF DRUG FROM LEAVES OF INSULIN PLANT.

1. Introduction :

Throughout history, humankind has always been interested in naturally occurring compounds from prebiotic, microbial, plants and animals' sources. Various extracts of different parts of plants have been widely used in folk medicines and perfumes as well as in food flavor and preservatives and are more commonly utilized in chronic as well as common diseases. Plants contain several active compounds such as alkaloids, steroids, tannins, glycosides, volatile oils, fixed oils, resins, phenols and flavonoids that are deposited in their different parts. The beneficial of the medicinal effects of the plant result from the combination of these active compounds.

The common name of *Chamaecostus cuspidatus* fiery costus or spiral flag is a species of herbaceous plant in the family costaceae native to European Brazil. In India it is known as insulin plant for its proposed antidiabetic properties. The plant belongs to the family Costaceae. The Costaceae was first raised to the rank of family by Nakai on the basis of spirally arranged leaves and rhizomes being free from aromatic essential oils. The family Costaceae consists of four genera and approximately 200 species. The genus Costus is the largest in the family with about 150 species that are mainly tropical in distribution. The present review deals with the recent research carried out in the area of phytochemistry, pharmacological, biological activities, and safety of *Costus igneus* Nak. The synonyms of this plant are: *Costus cuspidatus, Costus igneus, Globba cuspidatus, Costus pictus,*

There are a wide array of evidences supporting the importance of food in disease management. Certain foods have been reported to aid in the prevention of diseases. Green tea consumption regulated aging and also aided in the prevention of Alzheimer's disease. Similarly, consumption of Mediterranean diet lowered the risk of cancer and coronary heart disease. The phytochemicals play a major part or atleast a part, in bringing out these effects on consumption. As the insulin plant possess a broad range of phytochemicals, it had been the core area for many studies, which aimed at exploring its health promoting potential.

Morphology : It is a perennial, upright, spreading plant reaching about two feet tall, with the tallest stems falling over and lying on the ground. Leaves are simple, alternate, entire, oblong, evergreen, 4-8 inches in length with parallel venation. The large, smooth, dark green leaves of this tropical evergreen have light

purple undersides and are spirally arranged around stems, forming attractive, arching clumps arising from underground rootstocks. Beautiful, 1.5-inch diameter, orange flowers are produced in the warm months, appearing on cone-like heads at the tips of branches. Fruits are inconspicuous, not showy, less than 0.5 inch, and green-colored .

Growth and propagation: Plant grows in either full sun or partial shade. It needs fertile soil and ample moisture, and is often planted near water. Propagation is by division of the clumps, cuttings, or by separating the offsets or plantlets that form below the flower heads. Mites and nematodes can be a problem, especially on light, sandy soil. The plant has no diseases are of major concern. India facing an explosive increase in the incidence of diabetes mellitus and, therefore there is an urgent need to find cost effective, if possible indigenous and safe drugs for diabetes. An ideal anti-diabetic drug will be one which lowers raised blood glucose to normal level without causing hypoglycaemia in any state of nutrition. In addition, modern therapies are far too costly to be used by the majority of diabetes sufferers relatively from poorer nations.

2.Review of Literature and Development in the subject (Previous work done in the relevant area):

The study of antimicrobial activity on various gram positive,gram neagative bacteria and fungi were used as a test organism . All the bacterial and fungal strain showed zone of inhibition with methonolic extract (1)

Similar work for the antibacterial activity of C. igneus was carried out by both paper disc diffusion method as well as agar well diffusion method. The plant extracts were found to be inhibitory towards bacteria tested. Gram positive bacteria tested are found to be more sensitive compared to gram negative bacteria. The stem and root extracts have shown maximum inhibition zone in both methods. The inhibition zone ranged from 8 to15mm in disc diffusion method and 11-33mm in agar well diffusion method (1)

After extensive literature search and to the best of our knowledge , this is the first study that determines the MIC and MBC of pure Costus pictus extract against four gram- negative periodontal pathogenic bacteriae such as P. gingivalis, P intermedia , F. nucleactum and A actinomycetemcomitans. The MIC and MBC are measure to identify the potency of an antimicrobial drug and are considered as the important entity in the diagnostic laboratories to confirm the resistance of antimicrobial agent. Sensitive strain will have relatively low value , whereas resistant strain have relatively high value. [2]

Costus igneus Nak (syn. *Costus pictus* D. Don, *Costus mexicanus* Liebm ex Petersen or *Costus congenitus* Rowle), commonly known as fiery costus, Step ladder or Spiral flag or Insulin plant, is native

to South and Central America. This is a recent introduction to India from America as an herbal cure for diabetes and hence commonly called as 'insulin plant.'[3] It is widely grown in gardens as ornamental plant in South India and also run wild in many places.[4] It is used in India for various medicinal purposes due to its antifungal activity. Also it is known that diabetic people eat one leaf daily to keep their blood glucose low.[5] Leaves of *C. igneus* were one among the plants known to be effectively used for treating diabetes by the tribal people of Kolli hills of Namakkal district, Tamilnadu.[6] In Mexican folk medicine, the aerial part of *C. pictus* D. Don is used as an infusion in the treatment of renal disorders.[7]

Costus igneus is a traditionally used medicinal plant and a common member of ornamental plants in south Indian Gardens. Leaves are the important part which produces significant antidiabetic activity.[8,9] It reduces fasting as well as postprandial blood glucose levels. But the exact mechanism of action behind the antidiabetic activity is not known yet.[10] Along with the antidiabetic activity, insulin plant also reduces the diabetic associated complications; bring renal, hepatic parameters to a controlled level, decreases the amount of glycosylated haemoglobin, corrects the lipid profile, increases body weight as well as insulin level and shows marked improvement in the histopathological examination.[11,12,13]

Apart from the anti-diabetic property , some researchers have proved that this herb is boasted with various pharmacological activities, such as diuretic , hypolipidemic, antimicrobial, antioxitant and anticancerous. In addition, the research also reveals the presence of various phytochemicals, such as truterpenoids, carbohydrates, alkaloids, proteins, saponins, tannins, steroids, flavonoids.

3. Objectives of Research/ Proposed Hypothesis:

The specific objectives of this study are

1. To collect *Chamaecostus cuspidatus*(Nees & Mart.) C.D. Specht& D.W. Stev from Latur District
2. To Isolate crude drug from *Chamaecostus cuspidatus*(Nees & Mart.) C.D. Specht& D.W. Stev
3. Characterization and purification of crude drug from *Chamaecostus cuspidatus*(Nees & Mart.) C.D. Specht& D.W. Stev

4. Methodology to be adopted:

a. Extraction Process Maceration/ Percolation/ Digestion/ Infusion/ Pressurized Liquid Extraction (PLE)/ Soxhlet Extraction /Steam Distillation/Hydro Distillation/Microwave Assisted Extraction (MAE)

b. Isolation and identification Thin Layer Chromatography (TLC)/Column Chromatography (CC)/Gas Chromatography (GC)/ High Performance Liquid Chromatography (HPLC)/High

Performance thin Layer Chromatography (HPTLC)/Optimum performance laminar chromatography(OPLC)

c. Purification of crude drug

d. Antimicrobial methods to be adopted – Petriplate method

5. Importance of study/ Society aplication:

International Status:

Phytochemicals are bioactive compounds received from vegetation broadly carried out in conventional natural medicine (Bansode and Salalkar, 2015). Phytochemicals arise in medicinal vegetation, leaves, vegetables, and roots that need to outline the mechanism and guard against diverse diseases. Phytochemical research has received plenty of hobby amongst plant scientists due to the improvement of modern era and complex outcomes (Muthukumar et al., 2019). In recent years, research supplied records that the antimicrobial sports of medicinal plants is probably because of the secondary metabolites it produces that supplies medicinal agents. Phytochemicals with enough antibacterial efficacy deals with the bacterial infections (Sardessai et al., 2014). Misusage of antibiotics to cope with infectious illnesses create bacterial pathogenicity and resistant strains (Read and Woods, 2014). Different methods to explore the various medicinal properties of C. igneus are developing to make effective and cheaper natural antibiotics with more significant potential, thus possessing minimal side effects. Given the persistence and prolific nature of C.igneus and its potential uses, which aimed to determine the phytochemical properties of C. igneus and assess its antibacterial activities. Furthermore, the cytotoxic assay was also performed. This study provides a preliminary study that a more specific bioassay can further support after isolating active compounds.

National Status :

India represents 49 percent of the world's diabetes burden, with an estimated 72 million cases in 2017, a figure is expected to almost double to 134 million by 2025. Prevalence of Diabetes has increased by 64 percent across India over the quarter-century, according to a November 2017 report with an advocacy by the Indian Council for Medical Research, Institute for Health Metrics and Evaluation, and the Public Health Foundation of India. It has been estimated that in 2018 there were more than 500 million prevalent cases of type 2 diabetes worldwide(Kaiser et al., 2018).

Ayurveda is comprised of two Sanskrit terms. "Ayur" means life and "veda" means knowledge. Ayurveda has been extensively used for improving the wellness of the body. Diabetes mellitus is a known metabolic disorder of varied etiology characterized by chronic hyperglycemia due to relative deficiency

of insulin or its resistance. Diabetes is associated with disturbances of carbohydrates, fat and protein metabolism. Since oral hypoglycemic agents cause side effects, there is a growing interest in herbal remedies for the treatment of diabetes mellitus. Herbal drugs are considered to be less toxic and free from side effects compared to synthetic drugs (Grover et al., 2002).

The treatment of diabetes using the *Chamaecostus cuspidatus* plant has no side effects. The anti-diabetic effect of its leaves is currently been tested in diabetic patients. Studies reveal its role in various diseases, which opens up new clinical research areas. Investigations are needed to analyze the mechanism of action of the compounds and standardization of herbal drugs using models and this in turn would be useful to provide many links to develop various kinds of ant diabetic drugs in low costs. Medicinal plants are better to use in the treatment than conventional medicine.

Significance of the study :

1. In Tamilnadu the people consumed fresh and dried powder leaf forms for the treatment of diabetis.

2. To know the naturally occurring compounds in the leaves of insulin plant [*Chamaecostus cuspidatus*].

3. Aerial parts used for treatment of renal disorders.

4. Study is important to know mechanism of action of antimicrobial activity of naturally occurring compounds in the leaves of Insulin plant.

Medicinal uses of Leaves : The diabetes patients have to chew down the Insulin plants leaves for a month. That is the patient has to take two leaves per day in the morning and evening for one week. Care should be taken that the leaves must be chewed well before swallowing. Then after one week, the patient should take one leaf each in the morning and evening. This dosage should be continued for 30 days. Allopathic doctors also recommend this and are found to be effective in bringing blood sugar levels under control. The catchphrase of insulin plant is “a leaf a day keeps diabetes away”.

Many synthetic drugs used to cure the diabetes are very harmful and producing the ill effects of drug on patient body. Insulin plant does not cause any toxicity when consumed in higher quantities. However, it is advisable to limit your consumption to one or two fresh leaves or 10 to 25 gm of dried powder a day. Consumption of the leaves are believed to lower blood glucose levels and diabetics who consumed the leaves of thin plant did report a fall in their blood glucose level. That is why research topic is selected.

6. Proposed work Plan/ Formulation and Structure of Study:

- ✓ Reference work will be done through Journals available by visiting reputed libraries
- ✓ Isolation and identification of crude drug
- ✓ Screening of crude drug
- ✓ Characterization and purification
- ✓ Ph.D. Thesis will submit in third year

Year-wise Plan of work and targets to be achieved

a. First Year

Reference work

Literature survey

Thesis reading

Isolation of crude drug

b. Second Year

Characterization and purification

c. Third Year

Thesis writing

Submission of Pre Ph. D. Synopsis

Submission of thesis

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Research Scholar **Research**

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